

RESULTS OF SPRING 2012 RED AND GREY SQUIRREL SURVEYS



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1. SUMMARY

This report details the results of red and grey squirrel presence/absence monitoring organised by Saving Scotland's Red Squirrels in Spring 2012. The results were compared to similar surveys undertaken Spring and Autumn of 2011. The results show a continued overall increase in the distribution of red squirrels and decrease of grey squirrels in our sample over the year Spring 2011 to Spring 2012. Even with some recovery of grey squirrels to places where they had been absent in Autumn 2011, the overall trend was in favour of red squirrels.

A number of sightings transect squirrel counts were carried out in Spring and Autumn of 2011 and again in Spring 2012 to try to measure the effects of SSRS project trapping on the numbers of the two species of squirrel. The results were variable and largely dependent on the site.

2. AIM OF THIS REPORT

One of the aims of Saving Scotland's Red Squirrels is to stop the decline of Scotland's core red squirrel populations. North of the Central Belt we are working to prevent the further replacement of red squirrels by grey squirrels by targeting grey squirrel control at the places where grey squirrels were spreading outwards from Aberdeen and northwards from the Central Lowlands. This is carried out by a combination of Project staff, landowners and householders trapping in concert to form a co-ordinated Red Squirrel Protection Network. In Aberdeenshire grey squirrel control has been underway since Autumn 2007, while in the Central Lowlands it has been established over the period 2009-2012.

The monitoring described in this report was set up in 2011 to provide evidence on which to assess the effects of grey squirrel control on both red and grey squirrel populations. This document reports the results of the Spring 2012 surveys and compares them to results obtained in 2011.

3. METHODS

The monitoring was based upon three scales of data collection:

- i. Broad-scale: use of sightings data to record Scotland-wide distributions. We do not report these here.
- ii. Medium scale: use of feeder-box monitoring or sightings transects in tetrads to provide presence/absence data.
- iii. Fine-scale: sightings transects in a limited number of woodland sites to provide squirrel counts.

Here we report on the tetrad and sightings transect methods of monitoring red and grey squirrels in the North East of Scotland and the Central Lowlands (Tayside and Argyll & Trossachs).

4. TETRAD PRESENCE/ABSENCE MONITORING

To find out whether red and grey squirrels are present or absent in a particular area, monitoring tetrads (2 x 2km squares) were set up in 2011. In each tetrad four feeder boxes were positioned to sample right across the square, each with a squirrel hair-collecting pad or 'sticky'. Each feeder box was visited by volunteers a total of three times, over a period of six weeks and three hair samples collected from each box. Hairs were identified under a microscope. Each tetrad was then allocated to one of the following four categories: red squirrels only, grey squirrels only, both species or neither species.

In a number of tetrads where other groups already had long-term sightings transect surveys under way we adopted these as a substitute for feeder-boxes as a method of determining presence/absence. This occurred mainly in the Loch Lomond and the Trossachs National Park, where transects of a recognised standard methodology were carried out in Spring and Autumn of each year.

In Spring 2011 the project set up 47 tetrads across the Project area. The project continued to set up further tetrads during the Summer of 2011, and in Autumn of 2011 a total of 93 tetrad surveys were completed. This allows a direct comparison at two points during the year's routine Project trapping of grey squirrels. The surveys were carried out again in Spring 2012. This time 96 tetrads were completed correctly and returned results. 44 of these had been surveyed in Spring 2011 to allow direct comparison between years at a similar point in the life-cycle of the squirrel populations (winter survivors before recruitment of Spring 2012 juveniles). Because of a more comparable sample size, we also compared the results from Autumn 2011 (carried out August/September, so probably prior to the main dispersal period for young squirrels, i.e. population maximum) and Spring 2012 (population minimum).

The spring 2012 surveys

Project Area	Completed tetrads	Incomplete tetrads
Argyll & Trossachs	32	2
North East	31	6
Tayside	33	8

Tetrad data available for Spring 2012 survey analysis

The Table above shows the number of tetrad surveys set up in Spring 2012. A total of 96 were completed, which gives us a good total of 78 tetrads which can be directly compared with the previous Autumn. Unfortunately 16 tetrads that were set up were not completed, making their data unsuitable for inclusion in the analysis. In some cases, the sticky pads

went missing, a hazard of the method. In other cases, tetrads were not done at all or only partially done, either because forest operations or storm damage interrupted the survey or because volunteers were unable to complete the survey.

Results

The following table sets out the results the squirrel species detected at each tetrad in the 3 surveys for the entire Project area:

Survey season	Red squirrels only	Grey squirrels only	Both Species	Neither species	Total no. of tetrads
Spring 2011	18	4	18	7	47
Autumn 2011	46	15	24	8	93
Spring 2012	58	9	25	4	96

For those people who are interested to see the results obtained closer to home, we have split the results into the three Project areas: (Maps and tables showing the results of the 2012 surveys appear at the back of this report.)

Argyll & Trossachs

Survey season	Red squirrels only	Grey squirrels only	Both Species	Neither species	Total no. of tetrads
Spring 2011	15	2	7	4	28
Autumn 2011	21	1	5	2	29
Spring 2012	25	2	4	1	32

North East Scotland

Survey season	Red squirrels only	Grey squirrels only	Both Species	Neither species	Total no. of tetrads
Spring 2011	3	2	6	3	14
Autumn 2011	17	7	4	3	31
Spring 2012	19	5	6	1	31

Tayside

Survey season	Red squirrels only	Grey squirrels only	Both Species	Neither species	Total no. of tetrads
Spring 2011	0	0	5	0	5
Autumn 2011	8	7	15	3	33
Spring 2012	14	1	16	2	33

Replacement Index

One way to compare the results of pairs of tetrad surveys is to calculate a Replacement Index using a table showing the changes that occurred in each tetrad between two surveys. The following Replacement Index table compares the results for the 44 tetrads that were completed in both the Spring 2011 and Spring 2012 surveys.

		Spring 2012								
		Red	Both	Neither	Grey	Total				
	Red	17	1	0	0	18				
g -	Both	10	6	0	0	16				
2 ri	Neither	5	0	1	0	6				
2 Sp	Grey	2	0	0	2	4				
	Total	34	7	1	2	44				

The table presents all the possible changes to the tetrads and how many fall into each of four categories: red squirrels only, both red and grey squirrels, neither species, grey squirrels only. The rows describe the state of the tetrad in the Spring 2011 survey and the columns the tetrads in the Spring 2012 survey. For example, 10 tetrads had both species of squirrel in Spring 2011 but only reds in Spring 2012; and 6 tetrads had both red and grey squirrels in both the 2011 and 2012 surveys. It is noteworthy that one tetrad (NN2404, located at Glen Croe in Argyll & Trossachs), which had previously detected only red squirrels in 2011, detected both species in 2012.

The shaded diagonal represents no change. Above the shaded diagonal, the changes represent changes in favour of grey squirrels; below the diagonal they represent changes in favour of red squirrels. We can calculate a Replacement Index as follows:

(sum of values above the diagonal) - (sum of values below the diagonal) (the sum of all values in matrix except the "neither-neither" value)

A positive index represents a change in favour of grey squirrels and a negative index represents a change in favour of red squirrels. The Replacement Index comparing Spring 2012 with Spring 2011 is calculated to be -0.37. This is an index showing a substantial change in favour of red squirrels, although because of a small sample size we cannot be completely confident that the result represents the situation on the ground.

For the comparison between Spring 2012 and Autumn 2011, we had a larger sample size of 78 tetrads that were surveyed on both occasions:

		Spring 2012							
		Red	Both	Neither	Grey	Total			
	Red	32	6	0	0	38			
<u>ہ</u> ہے ۔	Both	9	8	0	3	20			
3 tr	Neither	5	1	2	0	8			
A U	Grey	1	8	0	3	12			
	Total	47	23	2	6	78			

In this case, the larger number of changes (24) were beneficial to red squirrels, mostly through a loss of grey squirrels from tetrads previously with both species (9), or red squirrels now being detected in squares that had previously not detected any squirrels (5). However, in Spring 2012 there were nine tetrads showing change in favour of grey squirrels; 6 changed from "red only" to "both species" and 3 changed from "both species" to "grey only".

The Replacement Index for this survey period was calculated as -0.20. This negative value again represents a positive situation for red squirrels, although not as great as for the Spring 2012 /Spring 2011 data. However, the larger sample gives us greater confidence in the survey results.

Discussion

The changes that the surveys have detected over the year Spring 2011 to Spring 2012 suggest a positive result for all the work done by the Red Squirrel Protection Network. The change over the full year Spring to Spring is obviously greater than the change between the Autumn and Spring, but both pairs of changes were in favour of red squirrels. We have seen some evidence of recolonisation by grey squirrels between Autumn and the following Spring, which is not unexpected, as the main season for dispersal for young squirrels occurs during the Autumn, particularly October-November, whilst our Autumn surveys were completed in September.

We will require a maintenance of this trend over future annual surveys to be sure that our grey squirrel control work is having a sustained effect, but these results are certainly promising. The Spring 2012 record of grey squirrels turning up in Glen Croe has served as a warning to increase our control efforts in that area, as this is on what is thought to be the main dispersal route between Loch Lomond and the red-only region of Argyll.

5. TRANSECT SURVEYS

In an effort to discover whether the Project's trapping network was having a measureable effect on the numbers of grey and red squirrels in Project Areas, we set up and carried out a number of walked sightings transects. These were usually 1km long, and walked 3 times by staff or volunteers over the space of a fortnight. Transects were walked in the early mornings – the time when virtually all the squirrels in the population are out and about – and were done in a standard way involving slow walks and five-minute stops, so that the whole kilometre would take 1³/₄ hours.

The results from a specific sample of the 2011 transect surveys were reported in "The Evaluation of grey squirrel control in the Saving Scotland's Red Squirrels partnership project 2009-2011", as were the results of the 2011 tetrad surveys. These were 10kms of transects in a group of linked woodlands on the western edge of Aberdeen, two sets of transects in two sites in the Argyll and Trossachs area and one set in a site in Tayside. The Aberdeen transects and the one in Tayside were carried out in Spring and Autumn 2011, whereas one of the Argyll and Trossachs transects was done in Summer and Autumn 2011 and the other in Winter and Spring 2011. The 2011 intensive transects sites in Argyll & Trossachs are presented in Table A.

 Table A. Intensive sightings transect squirrel counts of two sites in Argyll & Trossachs

 undertaken before and after trapping in 2011

		igth m)	Red Squirrel Count ਉਹ ਿ per Km			Grey Squirrel Count per Km		
Region	Location	Len (ki	Before Control	After Control	Differ -ence	Before Control	After Control	Differ -ence
A&T Study	Callander Crags & Brackland Park (Jun-Jul 2011 and Sept 2011)	5.00	0.80	2.40	+1.60	1.60	0.20	-1.40
Site Transects	Loch Lomond Golf Club & Ross Park (Jan 2011 and April 2011)	4.00	0.00	0.00	0.00	5.20	1.60	-3.60

2012 Results

All but the two intensive Argyll and Trossachs sites were repeated in Spring 2012 and the results compared with both Spring 2011 and Autumn 2011 in Table B. Separate average results are calculated for North East Scotland and Argyll and Trossachs.

Discussion

A general observation of these results is that the direction and size of change is very much site dependent. However, there is a trend for both red and grey squirrel counts to decrease between Spring 2011 and Spring 2012 (although not the case for all sites); and the Spring-to-Spring grey squirrel counts declined by more (-2.84 squirrels per km in North East Scotland; -2.57 squirrel per km in Argyll & Trossachs) than the red squirrel counts (-0.16 squirrels per km and -1.49 squirrels per km respectively).

These results point to the low detectability of squirrels by the transect count method, with weather, canopy cover, seasonal food distribution and timing in relation to the annual breeding cycle affecting the likelihood of seeing squirrels along the transect route. Probably the main use of the transects is for a comparison between sites. For example, at Blacktop, Gairnhill, Carnie Woods and Callander North you would have an excellent chance of seeing red squirrels most years, whereas Murtle Den, Hutton Institute, Newton Dee, Balloch Castle and Loch Lomond Golf Club are unlikely to have red squirrels at any time. Likewise, at Gairnhill, Kingshill, Carnie Woods, Castle Forbes, Cnoc a' Mhadaidh, Glentarken Wood ,Loch Ard Forest and Rowardennan you would be unlikely to see grey squirrels but Newton Dee and Balloch Castle Park are thronging with greys.

A point of note is that in Table B, the asterisks denote incomplete transects – usually brought about when the full set of 3 transect walks has not been done. Although we have included these results here so that some idea of numbers at a site can be seen, incomplete results cannot be included in statistical calculations, and are therefore wasted. It is worth making the point that volunteers should endeavour to carry out the full surveys, and if unable to complete them, to please let the SSRS Surveyor know so that a substitute volunteer or staff member can get them done.

SSRS will carry out the transects again in Spring 2013 and possibly 2014 to see whether more identifiable trends occur in the longer term.

			Red Squirrel Count per Km			Grey Squirrel Count per Km				
						Spring 2012-				Spring 2012-
. .		Length	Spring	Autumn	Spring	Spring 2011	Spring	Autumn	Spring	Spring 2011
Region	Location	(km)	2011	2011	2012	Difference	2011	2011	2012	Difference
NE	Blacktop	1.30	6.15	10.77	14.62	+8.47	0.77	0.00	1.54	+0.77
Countesswells	Foggieton	0.50	2.00	0.00 (1.5)	2.50 <i>(0.8)</i>	+0.50	0.00	0.00 (1.5)	1.25 <i>(0.8)</i>	+1.25
Complex	Murtle Den	1.00	0.00	0.00	0.00	0.00	3.00	5.00	0.00	-3.00
	Gairnhill	1.00	15.00	8.00	9.00	-6.00	0.00	0.00	0.00	0.00
	Kingshill	0.60	1.67	13.33	20.00	+18.33	0.00	0.00	0.00	0.00
	Hazlehead (Crematorium)	2.00	5.00	4.00 (1.0)	3.00 (1.0)	-2.00	4.50	0.00 (1.0)	0.00 (1.0)	-4.50
	Hazlehead (Den Wood)	1.60	0.00	1.82 (1.1)	2.00 (1.0)	-2.00	5.63	0.00 (1.1)	0.00 (1.0)	-5.63
	Hutton Institute	1.00	0.00	0.00	0.00*	0.00	10.00	0.00	0.00*	-10.00
	Newton Dee	1.00	0.00	0.00	0.00	0.00	14.00	33.00	6.00	-8.00
NE Other	Carnie Woods	1.00	25.00	10.00	21.00	-4.00	0.00	0.00	0.00	0.00
Transects	Castle Forbes	5.00	0.00	0.40	0.67 <i>(3.0)</i>	+0.67	0.00	0.00	0.00 (3.0)	0.00
	Crathes	2.00	12.00	6.50	2.00	-10.00	0.50	0.50	0.00	-0.50
	Drum Oak Wood	1.10	10.90	3.64	0.91	-9.99	7.27	13.64	0.00	-7.27
	Seaton	1.20	-	0.00	0.00	-	-	5.00	2.50	-
	AVERAGE		5.98	4.18	5.41	-0.16	3.51	4.08	0.81	-2.84
	AVERAGE		(n=13)	(n=14)	(n=14)	(n=13)	(n=13)	(n=14)	(n=14)	(n=13)
A&T Tetrad	Achray Forest	2.00	0.50	1.00	0.00	-0.50	0.00	0.00	0.00	0.00
Transects	Ardgarten Forest	1.00	4.00	0.00	0.00	-4.00	0.00	0.00	0.00	0.00
	Balloch Castle Park	1.00	0.00	0.00	0.00	0.00	29.00	25.00	13.00	-16.00
	Callander North	0.70	20.00	20.00	8.57	-11.43	7.14	18.57	0.00	-7.14
	Cnoc a' Mhadaidh	1.00	2.00	1.00	2.00	0.00	0.00	0.00	0.00	0.00
	Glentarken Wood	1.00	1.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00
	Loch Ard Forest	1.00	2.00	2.00	0.00	-2.00	0.00	0.00	0.00	0.00
	Callander Lower Wood	1.00	-	2.00	1.00	-	-	1.00	0.00	-
	Rowardennan Forest	1.00	1.00	1.00	6.00	+5.00	0.00	0.00	0.00	0.00
	Strathyre Forest East	2.00	2.00	6.00	1.50	-0.50	0.00	0.00	0.00	-0.00
	AVERAGE		3.61	3.30	2.01	-1.49	4.02	4.46	1.30	-2.57
			(n=9)	(n=10)	(n=10)	(n=9)	(n=9)	(n=10)	(n=10)	(n=9)
TAYSIDE Transects	Taymount	2.00	0.50	4.00 (1.0)**	5.00	4.50	2.00	0.00 (1.0)**	0.00	-2.00

Table B. Spring and autumn sightings transect squirrel counts (per kilometre of transect line) for 2011-12

*only 1 repetition; **Only 1 repetition of 1 of the transects in Autumn 2011; n is the total number in the sample used to calculate the average; () length of transect if different from other years.

6. SUMMING UP

The results of the surveys undertaken by a hard-working team of volunteers and Project staff have provided evidence of a trend in favour of red squirrels in our Project areas. In particular, the tetrad surveys, with their 4 sample sites and 6-week duration, appear to be a relatively reliable way of detecting squirrels if they are there, and show a trend in the direction of declining grey squirrel distribution and at least a stabilisation of red squirrel range.

The results of the transect surveys appear to be so variable from site to site that general conclusions are difficult to draw at present. The data further highlight the annual variation in squirrel numbers even within sites, which most likely reflects variation in food availability; this changeability of squirrel numbers is a well established phenomenon in squirrel population dynamics. We plan to carry out detailed analysis of grey squirrel control effort over a larger area to find out how this affects local counts of red and grey squirrels. Over the longer term, the information may have value as a part of the historical trends in each site, and they can certainly be used to identify woodlands where it is relatively easy to see red squirrels.

Saving Scotland's Red Squirrels wishes to thank all the volunteers who gave up their time to help us collect this data, and all those landowners who co-operated by allowing us access to their land.

In spring 2013 we will repeat the established tetrads and will have further tetrads ready to run in the Scottish Borders, Dumfries & Galloway and South Ayrshire. Here in Southern Scotland the Project is engaged in a battle not only with grey squirrels, but also with the Squirrelpox virus that the greys of that region are carrying, increasing the danger to red squirrels many-fold. It will be interesting to be able to compare these two differing regional situations as we continue to try to protect red squirrels against replacement by their grey cousins.





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Tetrad results 2012

Nort	North East		Trossachs	Tayside		
Tetrad	Species	Tetrad	Species	Tetrad	Species.	
NJ5414	Both species	NN2404	Both species	NN7222	Both species	
NJ5616	Red only	NN2601	Red only	NN7422	Both species	
NJ6218	Red only	NN2603	Red only	NN7622	Both species	
NJ6618	Red only	NN2804	Red only	NN8220	Both species	
NJ6816	Red only	NN3004	Both species	NN8622	Both species	
NJ6820	Red only	NN3206	Red only	NN9022	Both species	
NJ7214	Red only	NN4800	Red only	NN9228	Both species	
NJ7224	Red only	NN5200	Red only	NN9458	Red only	
NJ7616	Red only	NN5204	Red only	NO0242	Both species	
NJ7800	Red only	NN5417	Red only	NO0630	Red only	
NJ7820	Both species	NN5616	Neither	NO0634	Both species	
NJ8006	Red only	NN5632	Red only	NO1036	Red only	
NJ8200	Grey only	NN5812	Red only	NO1242	Grey only	
NJ8204	Red only	NN5824	Red only	NO1642	Both species	
NJ8404	Red only	NN6006	Red only	NO1644	Both species	
NJ8602	Both species	NN6008	Red only	NO2646	Both species	
NJ8604	Red only	NN6022	Red only	NO2750	Both species	
NJ8618	Red only	NN6208	Both species	NO2844	Both species	
NJ8804	Red only	NN6408	Red only	NO2848	Both species	
NJ9002	Grey only	NN6622	Red only	NO2854	Red only	
NJ9206	Grey only	NN6624	Red only	NO2856	Red only	
NJ9208	Grey only	NN6822	Red only	NO3250	Red only	
NJ9408	Grey only	NN7202	Grey only	NO3654	Red only	
NO6894	Red only	NN7402	Grey only	NO4254	Red only	
NO7094	Red only	NS3696	Red only	NO4448	Red only	
NO7496	Red only	NS3894	Red only	NO4450	Neither	
NO7694	Both species	NS4290	Red only	NO4850	Red only	
NO7894	Both species	NS4690	Red only	NO4856	Red only	
NO8288	Both species	NS4890	Red only	NO6070	Red only	
NO8484	Grey only	NS5098	Red only	NO6256	Both species	
NO8684	Neither	NS5298	Both species	NO6258	Neither	
				NO6961	Red only	
				NO7260	Red only	